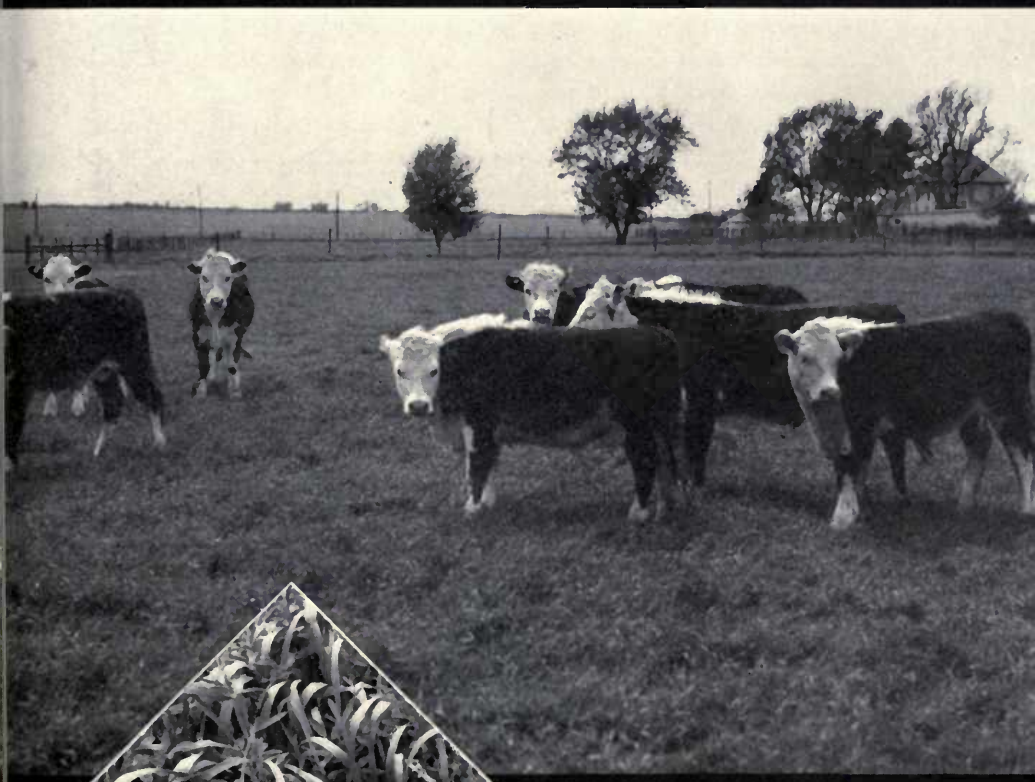
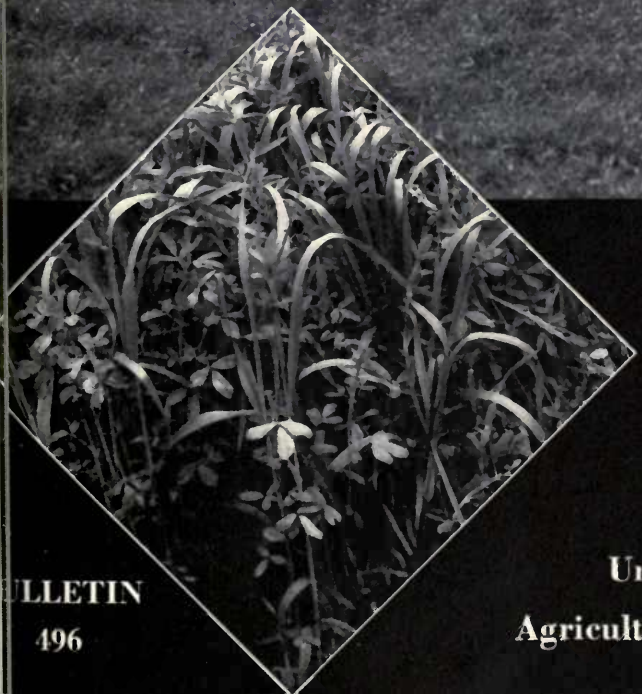
BROMEGRASS

And Bromegrass Mixtures





CULTURE AND UTILIZATION

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TABLE 1.—FORAGE YIELDS WHEN BROMEGRASS WAS SEEDED ALONE AND WHEN SEEDED WITH ALFALFA, ALHAMBRA EXPERIMENT FIELD, 1941 AND 1942
(Pounds per acre, oven-dry basis)

Cutting date	Bromegrass	Bromegrass-alfalfa	Cutting date	Bromegrass	Bromegrass-alfalfa
1941			*1942*		
May 22	408	2 292	May 9	570	1 166
July 10	471	1 654	July 30	1 062	2 554
August 13	176	198	October 15	922	1 714
October 17	.....	1 187			
December 4	292	133			
Total	1 347	5 464	Total	2 554	5 434

A good supply of available nitrogen is required for the best growth of bromegrass. Seedings made on soils low in nitrogen have frequently failed. The nitrogen needed may be secured from legumes, manure, or fertilizers.

An illustration of how the total forage yield is increased by growing a legume with bromegrass has been shown on the Alhambra experiment field in southwestern Illinois (Table 1). Two four-acre fields were seeded in 1939, one with bromegrass alone and the other with a mixture of bromegrass and alfalfa. Bromegrass made a good stand on both fields, but where it was seeded alone the plants were small and unthrifty. Where alfalfa was added, the bromegrass plants were large and productive.

Bromegrass Is Long-Lived

When sowed on fertile soil and managed well, bromegrass is long-lived. Evidence of this was obtained on pastures of the Illinois Station

TABLE 2.—PERSISTENCE OF BROMEGRASS IN A MIXED SEEDING
(Mixture was seeded at Urbana in April, 1933, and area used continuously as a pasture after May, 1934)

Sampling date	Bromegrass (40 percent in seeding)	Kentucky bluegrass (27 percent in seeding)	Redtop (20 percent in seeding)	White clover (13 percent in seeding)
	Percentage of each kind of plant surviving			
July 8, 1936	89.8	8.7	1.36	0
April 19, 1938	60.2	38.5	1.00	0
April 19, 1939	65.3	32.9	1.80	0
August 21, 1939	57.1	42.9	Trace	0
October 16, 1940	50.0	49.0	Trace	0
November 3, 1941	52.8	46.6	Trace	0

at Urbana over a period of six years. One field, seeded in 1933 with a mixture containing 40 percent bromegrass, 27 percent Kentucky bluegrass, 20 percent redtop, and 13 percent white clover, was used continuously as a pasture since 1934. In November, 1941, it contained 52.8 percent bromegrass and 46.6 percent Kentucky bluegrass (Table 2). The proportion of bromegrass was slightly larger than in 1940, probably because of seasonal variation, but it had remained fairly constant since 1938.

GROWING PRACTICES

Seedbed Preparation

Bromegrass and an alfalfa-bromegrass mixture require a good firm, clean seedbed. Bromegrass is slow in getting started, and the seedlings do not compete well with weeds or other grass already established. Spring-seeded bromegrass does not begin to produce underground stems (rhizomes) until late in the fall.

The same fertilizer and lime applications that are needed when alfalfa is seeded alone should be used when alfalfa is seeded with bromegrass. A nitrogenous fertilizer is not required, since the alfalfa provides ample nitrogen. When bromegrass is seeded alone, it requires fertile soil containing a good supply of organic matter.

The best way to prepare the seedbed is to go over the field with a corrugated roller after plowing and harrowing. The shallow furrows made by the roller are excellent for holding broadcasted seed.

Time and Rate of Seeding

When bromegrass is seeded with alfalfa, time of seeding is determined by the local practice with respect to alfalfa. Fall plantings, preferably before September 1, are favored in southern Illinois. A successful stand of the mixture, however, was obtained on the Alhambra field in southwestern Illinois by sowing the bromegrass in the fall and the alfalfa early the following spring. Both fall and spring seedings of the mixture have done well in central Illinois, but fall seedings have been exceptionally free of annual weeds, which frequently infest spring plantings. In northern Illinois the brome-alfalfa mixture should be spring-seeded.

When bromegrass is used alone, early fall seedings are best. This is true in all parts of the state. After the plants are up, they seem to be hardy enough to withstand low temperatures.

The best seeding rate depends on the way the crop is to be used.

A fall seeding of bromegrass-alfalfa the following July. This 17-acre field is being allowed to recover after having been grazed in the spring by 90 head of beef cattle, most of which were mature. The field was pastured again in the fall.

When wanted mainly for seed, bromegrass planted alone should be sowed at the rate of about 12 to 18 pounds an acre; when it is to be used for hay or pasture, 15 to 20 pounds is the best rate. Alfalfa and bromegrass in a mixture should be seeded in a ratio of 2 parts alfalfa to 3 parts bromegrass. Six pounds of alfalfa and 9 pounds of bromegrass or 8 pounds of alfalfa and 12 pounds of bromegrass an acre have proved satisfactory under Illinois conditions for either pasture, hay, or seed.

Methods of Seeding

Bromegrass is hard to seed with a grain drill because the seed is light-weight even tho it is large. Usually the seed is broadcast by hand. If this is done on a quiet day, a uniform stand can be obtained. Another method is to mix oats or cracked corn with brome seed in the proportion of 15 pounds of brome to 1 bushel of oats or cracked corn, setting the drill to seed 2 bushels. Care should be taken not to drill too deep. To adapt a small windmill or hand-type seeder to bromegrass, it is necessary to add an agitator to the rotating element. A fourth method, used where the grass is part of a mixture, is to seed thru an endgate seeder.

When bromegrass and alfalfa are seeded together, it is best to broadcast the brome on a well-prepared seedbed; then follow with a drill, seeding the alfalfa from the grass-seeder attachment. The drill covers the brome seed uniformly.

When bromegrass is sowed alone or when alfalfa is not seeded with a drill, it is necessary to cover the brome seed or it will be carried away by a heavy wind or rain. A cross rolling with the corrugated roller will cover the seed, or a harrow can be used.

Care After Seeding

Either bromegrass or a bromegrass-alfalfa mixture should be permitted to become well established before being pastured. Spring seedings should not be grazed the same season. Fall seedings can be pastured lightly the next year. When a nurse crop is used, it should be pastured off or, preferably, cut for hay in late May or early June.

Where spring seedings of bromegrass are made without a nurse crop, the weeds can be cut without injuring the grass if the mower is set for high cutting. When the brome is fall-seeded, little mowing is ordinarily required to control weeds during the following year.

Good Pasture Management Important

It is best to pasture a mixture of bromegrass and alfalfa in such a way that considerable top growth remains during most of the season. The grass and alfalfa do not lose much of their palatability even if they are not grazed early in the spring. Naturally there is a period following flowering in which both plants become slightly less palatable, but this is of no consequence. They stay green and are much more palatable than other pasturage during the summer.

If the mixture is grazed closely, the crowns of the alfalfa will be destroyed and this plant killed off. Pasturing no shorter than 4 or 5 inches allows the stand to remain in good condition.

Experimental pastures at Urbana, which were seeded in 1933 with 40 percent bromegrass and a mixture of Kentucky bluegrass, redtop, and white clover, have been so managed that a good top growth still remains. As already stated, these pastures have been used since 1934 and still contain over 50 percent of bromegrass. Pure stands of bromegrass, however, become "sodbound," in time. Since this condition is not found in mixtures with alfalfa, it is assumed that the nitrogen furnished by the alfalfa plants prevents it.

On plots at Urbana, which were seeded in 1939 and pastured continuously by 10 to 15 sheep an acre during the seasons of 1940 and 1941, no change in the percentage of alfalfa and bromegrass was evident. Where the pasture was stocked with fewer sheep, there has been a noticeable decline in the percentage of alfalfa.

Bromegrass for Hay

Altho bromegrass and a bromegrass-alfalfa mixture are used mainly for pasture, both make excellent hay. They should be cut when the alfalfa is at the proper stage. Following a short recovery period, the field can again be pastured. A second cutting of hay will consist chiefly of alfalfa. Yields will vary, but 2 to 3 tons of air-dry hay per acre of an alfalfa-bromegrass mixture is not uncommon. The hay is leafy and compares very favorably with other high-quality hays.

Seed Production

With the increased plantings of bromegrass there has been a greater demand for seed. When grown for seed, bromegrass can be sowed either alone or with alfalfa and the aftermath used as hay or pasture. The seed heads of the bromegrass grow above the alfalfa and can easily be harvested with a small combine set high. Pure stands can be cut with either the combine or the binder. Bundles of bromegrass are handled by the grain separator in much the same manner as those of small grain except that fewer concave teeth are used and the air blast is usually shut off completely and the seed run onto a tarpaulin spread under the machine. The seed must, of course, be cleaned since considerable stem and leaf material comes thru with it.

Yields of seed from experimental plots at Urbana over a period of three years have varied from 250 to 400 pounds an acre. One grower in southern Illinois has obtained as much as 700 pounds an acre.

Where the crop is being grown for seed, special effort should be made to keep down weeds. In Illinois, soft chess (*Bromus mollus*), an annual weed-like form of bromegrass, and curled dock are most often found in the seed. Since soft-chess seed is difficult to separate, the plants should be destroyed before harvest. It is better to cut out curled dock, but most of the dock seed can be removed by a cleaning machine.

Alfalfa Best Legume for Brome Mixture

Mixtures of bromegrass and alfalfa have provided very good pasture for cattle and sheep at the Illinois Station and elsewhere. The Michigan Station demonstrated striking possibilities for this mixture in that state.[1] The Nebraska Station reports similar experience, particularly when the bromegrass was seeded with alfalfa or sweet clover.[2] Agronomists at the Wisconsin Station have confirmed these findings.

[1]Michigan Agr. Exp. Sta. Cir. Bul. 189. 1939.
[2]Nebraska Agr. Exp. Sta. Cir. 68. 1941.

Bromegrass can be grown wherever alfalfa can be successfully produced. One grower in south-central Illinois has reported outstanding results on relatively poor soil by using limestone and sweet clover before seeding a mixture of alfalfa and bromegrass. In 1941 he harvested 350 pounds of brome seed and 1½ tons of high-quality hay per acre. In addition, the aftermath furnished excellent pasture for about two months.

Sweet clover is frequently used with bromegrass. This mixture has a high carrying capacity, but the brome is apt to be overgrazed because it is more palatable than the clover. Also sweet clover must be reseeded every other year. Alfalfa and bromegrass, however, are equally palatable and therefore grazed equally. Red clover is too short-lived to use with bromegrass; hence it fits better in a short pasture rotation. For two- or three-year rotations red clover and Ladino clover (*Trifolium repens* L.) seeded with bromegrass deserve more extensive use, according to some preliminary tests at this Station.

EXPERIMENTAL RESULTS

Effect of Rainfall on Yields of Bromegrass

Altho bromegrass is drouth-resistant and heat-resistant, it grows very slowly during dry, hot weather, such as is common in Illinois during the summer months. The livestock grazing on it then are maintained mostly by the growth carried over from spring and early summer. With the return of cool weather in the late summer or early fall, bromegrass sends out new shoots but the growth is not so heavy as in the spring.

Some idea of the effect of rainfall on bromegrass yields on a 5-acre pasture during 1935-1940 is shown in Table 3. Weekly rainfall

TABLE 3.—BROMEGRASS YIELDS IN SIX DIFFERENT SEASONS, SHOWING EFFECT OF RAINFALL, URBANA, 1935-1940
(Bromegrass was seeded alone on a 5-acre tract: yields are on oven-dry basis)

Grazing season	Rainfall April 1 to October 31	Forage per acre
	inches	*lb.*
1935	25.51	10 400
1936	21.62	4 710
1937	25.89	7 066
1938	28.17	8 943
1939	23.72	4 796
1940	19.69	5 127

and the amounts of forage taken from this same pasture at different times during the season are indicated in Tables 4 and 5.

In 1935 and 1938 rainfall was ample and well distributed thruout most of the growing season and yields were high. On the other hand, 1936 was abnormally dry and hot and this is reflected in low yields. The season of 1939 was marked by a dry period during the spring and again in late summer, which reduced forage yields and retarded plant recovery during the fall. Both the amount of rainfall and its distribution affect forage yields.

In most years a large part of the growth on this pasture took place before August 1. Forage consumed after this date was for the most part the excess produced during the early period of rapid growth. That there was little growth in the fall is shown by the samples cut late in 1937, 1938, and 1940.

Consumption in the different seasons varied somewhat, sheep being used in some seasons and beef cattle in others. During 1937 and 1939, when sheep were pastured, not all available forage was eaten.

TABLE 4.—WEEKLY RAINFALL AT URBANA DURING THE GRAZING SEASONS 1935-1940
(Inches)

	1935	1936	1937	1938	1939	1940
April 1-8	1.10	1.56	2.34	2.92	.70	.82
April 9-15	.80	.06	.61	....	2.90	1.04
April 16-23	.23	.25	1.49	.14	1.72	1.27
April 24-30	.74	2.30	.96	.36	.07	.83
May 1-8	3.60	1.42	1.36	.40	.26	1.50
May 9-15	1.58	.46	.01	.64	.06	.55
May 16-23	1.01	1.00	1.22	3.08	.56	1.31
May 24-31	.74	1.06	....	.85	.31	1.17
June 1-8	.31	.26	3.13	.64	.47	1.43
June 9-15	.13	.09	.82	1.60	3.61	1.40
June 16-23	2.39	.01	.60	....	1.19	.63
June 24-30	.81	.11	.88	3.43	.90	1.58
July 1-8	1.72	....	.10	1.36	.99	....
July 9-15	.84	.43	1.59	.10	....	.80
July 16-23	.64	.10	....	2.46	.74	.02
July 24-31	.92	.82	.74	2.53	....	.13
August 1-8	1.30	.56	.19	1.77	1.43	.29
August 9-15	.80	1.58	.44	.11	1.06	.33
August 16-23	.20	.48	.17	1.55	3.89	.52
August 24-31	.06	.92	....	.85	....	1.66
September 1-8	1.11	.77	....	.05	.04	....
September 9-15	1.11	1.38	3.12	.24	....	.48
September 16-23	.01	.07	....	.59	.11	....
September 24-30	1.71	3.61	2.22	....	.17	....
October 1-8	.04	.48	.82	....	.93	.99
October 9-15	.44	.86	.33	.71	1.16	.42
October 16-23	.37	.99	2.77	1.79	....	....
October 24-31	.80	1.16	....	....	.45	.52
Total	25.51	21.62	25.89	28.17	23.72	19.69

TABLE 5.—GRAZING TEST WITH BROMEGRASS SEEDED ALONE URBANA, 1935-1940[a]

(Forage is on oven-dry basis; sheep and beef cattle were pastured on this 5-acre plot)

Period	Yields per acre[b]			Extent of pasturing			Animal gains[b]		
	Total	Consumed	Residual	Days on pasture	Animal unit days[c] per acre	Number of livestock	Total	Per acre	Per acre per day
1935	*lb.*	*lb.*	*lb.*				*lb.*	*lb.*	*lb.*
May 6-23	4 290	985	3 304	18	14.4	8 steers	663	133	7.37
May 24-June 20	2 900	2 275	3 929	28	22.4	8 steers	560	112	4.00
June 21-July 18	1 584	1 665	3 848	28	22.4	8 steers	90	18	.64
July 19-Aug. 29	1 327	2 788	2 387	42	33.6	8 steers	240	48	1.14
Aug. 30-Sept. 23	299	2 196	490	24	19.2	8 steers	30	6	.25
Total	10 400	9 909	.....	140	112.0	.....	1 583	317	....
1936									
May 26-June 22	3 877	302	3 575	28	28.0	10 heifers	860	172	6.14
June 23-July 20	−468	1 428	1 679	28	28.0	10 heifers	310	62	2.21
July 21-Aug. 18	844	1 433	1 090	29	29.0	10 heifers	0	0	0
Aug. 19-Sept. 15	457	1 233	314	27	27.0	10 heifers	170	34	1.26
Total	4 710	4 396	.....	112	112.0	.....	1 340	268	....
1937									
May 6-June 7	4 312	1 976	2 335	34	68.0	39 ewes 42 lambs	....	...	....
June 8-June 30	914	596	2 651	22	44.0	39 ewes 42 lambs	722	144	7.91
July 1-July 28	1 717	1 645	2 72ɔ	28	56.0	39 ewes 42 lambs	365	73	2.11
July 28-Aug. 15	184	0	2 499	0	....	0	....	...	....
Aug. 16-Oct. 29	133	0	2 007	0	....	0	....	...	....
Oct. 30-Nov. 17	−194	1 355	458	18	42.0	30 calves	2 530	506	36.14
Total	7 066	5 572	.....	102	210.0	.....	3 617	723	....
1938									
Apr. 14-May 11	3 055	1 171	986	28	24.0	30 sheep	448	90	3.20
May 12-June 8	828	1 851	1 885	28	24.0	30 sheep	285	57	2.03
June 9-July 6	2 186	1 843	852	28	36.0	45 sheep	91	18	.65
July 7-Aug. 3	2 143	1 614	1 194	28	36.0	45 sheep	195	39	1.39
Aug. 4-Aug. 30	425	1 222	2 649	28	36.0	45 sheep	30	6	.21
Sept. 1-Sept. 12	.....	.....	.....	12	15.3	45 sheep	5	1	.08
Sept. 13-Sept. 28	355	583	698	16	17.0	37 sheep	25	5	.31
Sept. 29-Oct. 13	− 49	390	258	14	14.8	37 sheep	28	6	.40
Total	8 943	8 674	.....	182	203.1	.....	1 107	222	....
1939									
May 1-May 26	1 955	461	1 494	26	26.0	5 steers	171	34	1.31
May 27-June 26	426	583	1 337	30	30.0	5 steers	196	39	1.31
June 27-July 24	526	149	1 714	28	28.0	5 steers	184	37	1.31
July 25-Aug. 21	139	543	1 310	28	28.0	5 steers	169	34	1.21
Aug. 22-Oct. 2	1 249	1 577	982	42	50.4	42 sheep	....	...	....
Oct. 3-Oct. 21	501	−200	1 683	19	22.8	42 sheep	....	...	....
Total	4 796	3 113	.....	173	183.2	.....	720	144	....
1940									
April 24-May 19	1 612	842	770	26	19.5	6 steers	254	51	2.54
May 20-June 14	2 608	1 959	1 419	26	33.8	10 steers	731	146	5.74
June 15-July 12	− 37	176	1 206	28	29.8	8 steers	110	22	.78
July 13-July 26	202	373	75	14	11.2	6 steers	50	10	.72
July 27-Aug. 23	405	748	190	28	14.8	4 steers	20	4	.14
Aug. 24-Oct. 4	435	766	58	42	22.4	4 steers	380	76	1.81
Oct. 5-Nov. 1	− 98	29	199	28	14.8	4 steers	−110	−22	−.78
Total	5 127	4 893	.....	192	148.3	.....	1 435	331	....

[a]The field was seeded in 1933. It was pastured in 1934, but no data were obtained then. [b]Negative results (−) were due to the method of random sampling used. [c]An animal unit day equals one day's grazing for either one mature cow, one 1,000-pound steer or heifer, seven mature sheep, or ten lambs.

Bromegrass as a Permanent Pasture

High forage yields and good gains were made by both cattle and sheep on the 5-acre experimental pasture during 1935-1940 (Table 5). In fact, few pasture forages are capable of producing such consistent gains for such a long time. Beef cattle were the chief grazing animals in 1935, 1936, 1939, and 1940. Sheep were used mainly in 1937 and 1938.

Annual production of forage during the six-year period was exceptionally high and was not exceeded by any other experimental pasture at Urbana during the same six-year period. Production fluctuated, however, according to the amount of rainfall, varying from 4,710 pounds in 1936, a year of abnormal heat and drouth, to 10,400 pounds in 1935, when rainfall was ample and well distributed.

Animal gains were good in all seasons, but they were exceptionally high in 1935 and 1937. During the fall of 1937 thirty Texas calves gained as much as 506 pounds an acre on this pasture in 18 days. Total acre gains during the grazing season ranged from 144 pounds made by beef cattle in 1939 to 723 pounds made by sheep and beef cattle in 1937.

Bromegrass nearing maturity. This is a portion of the 5-acre experimental bromegrass pasture (Table 5) when it was in its fifth year and was being grazed by 45 sheep. (*Picture was taken June 13, 1938.*)

No matter whether sheep or beef cattle were used as experimental animals, few differences occurred in any season in the amount of forage needed to produce a given amount of gain. Sheep are more selective than cattle, but when the pasture is short, the sheep eat whatever growth is available.

Bromegrass and Other Grasses and Grass Mixtures Compared

The quantity of forage produced by a bromegrass-alfalfa mixture is about the same as that obtained from alfalfa seeded alone. Management is an important factor in maintaining continuous yields from the mixed pasture, particularly where the ratio of alfalfa is low. Where this is the case, the alfalfa tends to die out rather quickly because the livestock graze it closely and on good soil the root system of bromegrass offers it strong competition.

In the spring of 1936 a bromegrass and an orchard-grass mixture were each seeded on 10 acres at Urbana. Both mixtures contained alfalfa, red clover, timothy, redtop, and Kentucky bluegrass. The bromegrass and alfalfa were sowed in the ratio of about 2 to 1. Hay was cut in 1937. Hereford steers and heifers were pastured on both fields in 1938, 1939, and 1940. In both 1939 and 1940 the weather was dry during July, August, and September.

In 1940 the percentage of alfalfa remaining in the bromegrass mixture was negligible. Close grazing during the dry periods was apparently the principal factor in eliminating it. The forage yields and animal gains from the bromegrass mixture, however, were higher than from the orchard-grass mixture (Table 6). Yields of both grasses were influenced by seasonal rainfall. The 1938 production of 8,383 pounds of

TABLE 6.—GRAZING TESTS WITH BROMEGRASS AND ORCHARD-GRASS MIXTURES, URBANA, 1938-1940

(Forage is given on oven-dry basis; sheep and beef cattle were pastured)

Grazing season	Forage yields per acre		Forage consumed per acre		Animal gains per acre	
	Bromegrass mixture	Orchard-grass mixture	Bromegrass mixture	Orchard-grass mixture	Bromegrass mixture	Orchard-grass mixture
	lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
1938	8 383	5 582	8 328	5 489	342	245
1939	4 598	3 284	4 394	3 277	216	169
1940	4 386	2 243	4 364	2 209	220	180
Average	5 789	3 703	5 695	3 658	259	198

TABLE 7.—GRAZING TESTS WITH KENTUCKY BLUEGRASS AND BROMEGRASS SEEDED ALONE, URBANA, 1935-1940

(Forage is given on oven-dry basis; sheep and beef cattle were pastured)

Grazing season	Yield per acre	Days pastured	Animal gains per acre
	Kentucky bluegrass		
	lb.		*lb.*
1935	3 779	109	84
1936	1 572	84	170
1937	3 578	94	269[a]
1938	3 761	202	160
1939	2 285	180	137
1940	3 116	188	162
Average	3 030	143	164
	Bromegrass		
1935	10 400	140	317
1936	4 710	112	268
1937	7 066	101	723[a]
1938	8 943	182	222
1939	4 796	162	144
1940	5 127	188	331
Average	6 840	148	334

[a]Includes gains made by western calves placed on pasture in November.

forage an acre from the bromegrass mixture and 5,582 pounds from the orchard-grass mixture was about 80 percent higher than the yields in the drier seasons of 1939 and 1940.

On the experimental plot at Urbana bromegrass yielded more pasture forage and supported larger animal gains than Kentucky bluegrass when each was seeded alone (Table 7). Kentucky bluegrass has many good points, however, which will continue to make it one of our better grasses for pastures and general purposes. It is persistent and aggressive, forming strong, uniform turf, and it furnishes good palatable forage during the early part of the season. Since the experimental pasture is of average fertility, yields of Kentucky bluegrass obtained on it are comparable to those ordinarily secured from Illinois pastures.

Comparison of Alfalfa, Bromegrass, and Orchard-Grass Pastures for Sheep

During 1939-1941 a series of small pastures were tested for forage yields, animal gains, and number of days of pasture they supplied for sheep. In the fall of 1937 and the spring of 1938 one of these pasture plots had been seeded to each of the following: alfalfa, alfalfa-bromegrass, bromegrass, orchard-grass-alfalfa, and orchard grass. Good

stands were obtained on all plots. In 1939 the plots were fenced and then stocked with yearling ewes at the rate of 10 to the acre. During each grazing season animal weights and forage yields were taken at monthly intervals. The animals were taken off the plots whenever the pasture became too short but they were replaced as soon as forage was available for them. In 1940 an infestation of soft chess made it necessary to clip the bromegrass plot, which drastically reduced both its yield and carrying capacity not only in that season but also in the following year.

The average annual yields of forage on the alfalfa and the alfalfa-bromegrass pastures were about the same (Table 8). The alfalfa-orchard-grass mixture produced about 1,300 pounds less forage per acre than the alfalfa and alfalfa-bromegrass mixture. The most striking difference in yield in this group of plots was between those containing alfalfa, either alone or in mixture, and the plots seeded only to bromegrass or to orchard grass. The average annual yield of alfalfa was 8,680 pounds an acre when seeded alone, 8,527 pounds seeded with bromegrass, and 7,300 pounds seeded with orchard grass; whereas the average annual yield of bromegrass seeded alone was 4,315 pounds

TABLE 8.—GRAZING TESTS WITH ALFALFA, BROMEGRASS, AND ORCHARD GRASS SEEDED ALONE AND IN MIXTURES, URBANA, 1939-1941
(Forage is given on oven-dry basis; sheep were pastured)

Grazing season	Alfalfa	Alfalfa-bromegrass mixture	Bromegrass	Alfalfa-orchard-grass mixture	Orchard grass
			Forage yield per acre		
	lb.	*lb.*	*lb.*	*lb.*	*lb.*
1939	8 802	9 135	6 444	9 142	4 990
1940	6 108	6 177	2 194	4 797	2 593
1941	11 130	10 270	4 306	7 961	2 194
Average	8 680	8 527	4 315	7 300	3 259
			Gains per acre made by sheep		
	lb.	*lb.*	*lb.*	*lb.*	*lb.*
1939	420	311	194	302	145
1940	310	330	130	202	162
1941	225	128	117	128	77
Average	318	256	147	211	128
			Sheep pasture days per acre		
1939	1 300	1 400	1 400	1 400	1 400
1940	1 570	1 330	705	1 265	880
1941	1 820	2 120	1 500	1 820	620
Average	1 563	1 617	1 202	1 495	967

an acre and that of orchard grass alone, 3,259 pounds. The much higher yields obtained when alfalfa was seeded with bromegrass and orchard grass show the advantage of using a legume in a grass mixture. Alfalfa seeded alone produced a large amount of forage, indicating the ability of this plant to yield high; but at the end of the 1941 grazing season the percentage of alfalfa in the stand had declined and it was being replaced by Kentucky bluegrass.

Gains made by sheep on this group of plots followed a pattern similar to that for forage yields. The highest gains were made on the plots containing alfalfa. Alfalfa seeded alone supported an annual gain of 318 pounds an acre; the alfalfa-bromegrass mixture, 256 pounds; and the alfalfa-orchard-grass mixture, 211 pounds. Bromegrass seeded alone supported annual gains of 147 pounds an acre; and orchard grass alone, 128 pounds. These figures again reflect the advantage of using a legume with grass in pasture mixtures. The larger gains made by the sheep on the plots with alfalfa were possible not only because of the larger yields of forage on these plots, but also because the alfalfa increased the nutritive value of the forage.

The total number of pasture days per acre supplied by each kind of forage was in general consistent with the forage yields and animal gains.

Chemical Composition of Different Pasture Forages

The chemical composition of a forage crop, as expressed in terms of protein, calcium, phosphorus, and magnesium, is generally considered to be closely related to its palatability. Many forages like Kentucky bluegrass are nutritious and palatable only during the spring and late fall. Other forages like alfalfa and bromegrass are palatable and have a high feeding value during the greater part of the season. Timothy also has a relatively high feeding value and is palatable, but it is not comparable to bromegrass.

Alfalfa and bromegrass, either of which has many desirable qualities when seeded alone, make a very good combination from the standpoint of feed value as well as ability for growth. Undoubtedly the alfalfa, by adding nitrogen to the soil, enables the bromegrass to produce more nutritious and palatable forage. By lessening the danger for cattle and sheep to bloat, as sometimes happens when they graze on legumes alone, bromegrass has done much to bring about the use of alfalfa as a pasture.

Chemical analysis revealed two outstanding facts about alfalfa, the bromegrass-alfalfa mixture, bromegrass, the orchard-grass-alfalfa

TABLE 9.—CHEMICAL CONTENT OF FORAGE FROM ALFALFA, BROMEGRASS, AND ORCHARD GRASS SEEDED ALONE AND IN MIXTURES, URBANA, 1940

Sampling date	Protein	Calcium	Phosphorus	Magnesium
	perct.	*perct.*	*perct.*	*perct.*
Alfalfa alone				
May 3	24.44	1.28	.376	.210
June 17	23.13	1.22	.441	.321
July 6	22.00	1.12	.335	.303
August 13	18.31	1.16	.260	.273
September 19	17.19	.681	.209	.271
October 10	17.38	.940	.297	.635
Average	20.41	1.067	.319	.335
Bromegrass-alfalfa mixture				
May 3	17.94	.841	.360	.155
June 17	23.56	1.05	.508	.326
July 6	14.63	.559	.342	.242
August 13	14.13	.778	.266	.261
September 19	20.56	1.39	.237	.324
October 10	16.25	.844	.256	.387
Average	17.85	.910	.328	.283
Bromegrass alone				
May 3	16.88	.341	.353	.116
June 17	11.56	.272	.190	.147
September 19	11.69	.793	.245	.294
October 10	12.69	.736	.275	.276
Average	13.21	.536	.266	.208
Orchard-grass-alfalfa mixture				
May 3	18.69	.949	.351	.206
June 17	14.80	.494	.444	.312
July 6	13.19	.949	.332	.304
August 13	13.52	.832	.258	.340
September 19	19.00	1.12	.236	.372
October 10	17.50	.681	.280	.346
Average	16.12	.837	.317	.313
Orchard grass alone				
May 3	16.81	.423	.368	.174
June 1	8.56	.194	.371	.147
July 6	6.81	.346	.301	.257
September 19	10.19	.552	.351	.306
October 10	13.69	.624	.183	.327
Average	11.21	.430	.315	.242

mixture, and orchard grass. First, the protein content of the alfalfa and of the alfalfa-and-grass mixtures was much higher than that of the grasses alone (Table 9). Second, the calcium content of the alfalfa and the alfalfa-grass mixtures was very high. The percentage of magnesium was also higher when alfalfa was present, but the difference was not so pronounced. The bromegrass showed a higher protein content than the orchard grass, the seasonal average for the bromegrass being

13.21 percent and that for the orchard grass 11.21 percent. No significant difference in phosphorus content was evident between the different pasture forages.

The protein content of a forage is a fair indication of its palatability, and palatability and animal gains are closely related. Protein content is generally highest during the early part of the grazing period, when the forage is most succulent. Consumption is also high during this time, showing that palatability, amount of forage consumed, and animal gains are closely related to the protein content. Since both alfalfa and bromegrass remain green and succulent for a longer time than orchard grass, they provide for a larger nutritive intake. This was brought out in the experiment with sheep on the different pasture plots (Table 8).

Strains of Bromegrass

Bromegrass is normally a cross-pollinated plant, with the result that many strains have evolved. In regions where it has been grown for

Improving bromegrass thru breeding. Individual strains of brome are covered with sacks to keep them from crossing. Selections are then made from the best plant types and these are crossed to produce better strains.

many years, distinct types are found that are larger, leafier, or produce more seed than others. A Canadian strain known as Parkland has been selected for its habit of growing in bunches, which is considered an advantage when used in mixtures.

Illinois plant breeders have tested a number of strains over a period of years, and these experiments are being continued. Altho no conclusions can be drawn as yet, there is some indication that southern

strains of seed, particularly from Kansas and Nebraska, are best adapted to southern Illinois and they have been found to thrive in northern areas also. Seed from Montana, Minnesota, and Canada is especially adapted to northern and north-central Illinois but not to the southern part of the state.

Summary and Conclusions

Yields and general performance of smooth bromegrass have been studied during a period of ten years by the Illinois Station. Tests were made at Urbana in eastern Illinois, at Alhambra in southwestern Illinois, and at Dixon Springs in the extreme southern part of the state. Field observations were also made on a number of farms in central Illinois.

These tests and observations show that bromegrass is outstanding in hardiness, resistance to drouth and heat, palatability, and nutritiousness. It also yields well and has a high degree of persistency as a pasture plant.

The excellent qualities of bromegrass are enhanced by seeding it in a mixture with alfalfa; but seeded either alone or in a mixture it produces good gains on cattle and sheep.

Bromegrass requires fertile soil and yields best where it is seeded with a legume or where barnyard manure is plowed down previous to seeding. On soils of relatively low fertility it has not been productive.

The pasture season can be lengthened as much as four to six weeks by using a mixture consisting mainly of bromegrass. Good management will carry a good growth thru the entire season from May to mid-October.

Yields of forage from bromegrass have been consistently high; and chemical analyses, as well as animal gains, show that it is nutritious. A mixture of bromegrass and alfalfa nearly equals alfalfa in protein and mineral content.

Tests comparing bromegrass, Kentucky bluegrass, and orchard grass show that bromegrass produces the most forage, makes possible the largest livestock gains, and provides for the longest period of grazing, doing away with some of the need for supplementary pastures or summer feeding.

BROMEGRASS is bound to become an important forage crop in Illinois. It is a nutritious, hardy, long-lived perennial, and makes an excellent pasture when seeded with alfalfa.

Brome is not difficult to grow. Any soil that will give good yields of alfalfa is suitable. A firm, clean seedbed is the first requirement. Seed is sowed in late August or early in the spring. Because it is lightweight it is usually broadcast by hand, then covered by a light harrowing or rolling. If sowed with a drill, it is mixed with oats or cracked corn. When seeded with alfalfa, the bromegrass is generally broadcast and the alfalfa drilled on top of it.

Until a stand is well established it should not be pastured. Once it has a start, it is not hard to maintain. For best results the stand should be kept grazed down to a height of 4 to 6 inches and a good top growth left on the field most of the season. Under good management a good growth of brome can be counted on for the entire season.

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